COCONUT CRAB (*Birgus latro*) SURVEYS ON PAGAN, COMMONWEALTH OF THE NORTHERN MARIANAS ISLANDS

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December 2010

INTRODUCTION

The coconut or robber crab (*Birgus latro*) has a wide distribution ranging from Eastern Africa, through the Indian Ocean islands to the Pacific Ocean islands (Fletcher and Amos, 1994). Due to its large size, ease of collection and palatable flesh, the coconut crab is often over-harvested when it occurs in the vicinity of human habitation. The Mariana Islands are no exception and this species is heavily harvested as a cultural resource. Surveys on Guam (USFWS, 2001), Saipan (Kessler, 2006) and Tinian (U.S. Navy, 2008) have documented over-harvested populations.

Coconut crabs are a type of hermit crab; however they abandon the necessity of residing in a discarded snail shell at a small size and go through life with no added protection other than their own carapace. They are the largest land dwelling invertebrate in the world and can reach a weight in excess of 5kg. Coconut crabs breed on land but the female releases the eggs in the ocean where they immediately hatch. The oceanic larval stage lasts 2-3 weeks (Fletcher and Amos, 1994). Once on land the growth rate is slow and it is estimated to take 8-10 years to reach the CNMI legal size limit of 3 inches (76mm) across the back (Brown and Fielder, 1991).

On the southern islands (Rota, Saipan Tinian and Aguiguan), the Commonwealth of the Northern Mariana Islands – Division of Fish & Wildlife has established a legal crab hunting season from September 15 - November 15. Only crabs with a carapace width larger than 3 inches (76 mm) are allowed to be taken and females carrying eggs (berried) of any size are prohibited. However on the northern islands, crabs are allowed to be harvested at any time of the year for subsistence by northern island residents but must be consumed on that island. Between 1920 and 1945 the Japanese government had a small copra plantation and military air base on Pagan. After 1950, local residents were allowed to return and establish a small village with about a hundred inhabitants. This village was evacuated in 1981 due to a volcanic eruption (Kessler *pers. com.*). Presently Pagan is uninhabited or inhabited infrequently by <10 people for short periods of time (Kessler *pers. com.*).

The goals of this study were to establish coconut crab abundance indices and population demographics on Pagan.

METHODS

Study Sites

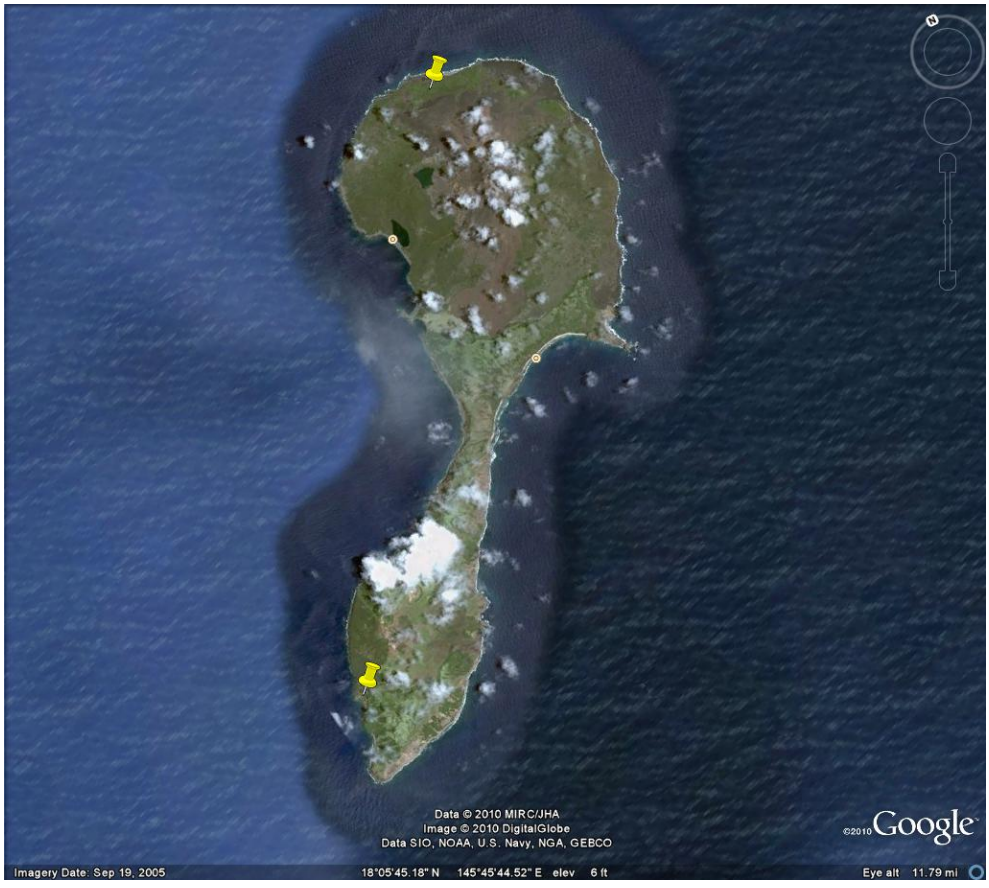
This study sampled coconut crabs on the southern and northern parts of Pagan. The northern area was located at Talague beach within coconut forest habitat and the southern area was on the southwest side with mixed coconut and native forest habitat (Figure 1.). The central portion of the island (near the old village and where more recent inhabitants dwell) was avoided due to speculation that past and present harvests have greatly depleted crab numbers in this area. The two sampled areas were deemed to be less likely to have been harvested or harvested as intensively.

Bait station transects

Coconut crab abundances were measured by transect lines of coconut bait stations. Each bait station consisted of a whole coconut that had fallen off the tree but still had juice and had not yet sprouted. A small hole (~3 cm diameter) was cut into the coconut exposing the meat and juice. The coconut was wired to a tree or stuck onto a cut sapling tree so that the coconut was 10-30 cm off the ground. Vanilla extract was then poured into the coconut to improve and intensify the scent. Crabs will remain feeding on bait coconuts and thus can be easily captured at night. All crabs found on the stations and between stations were measured for thoracic length (the hourglass shaped, middle portion on the dorsal side of the carapace), weighed, and the sex determined .The bait stations were spaced every 20 meters. The northern area consisted of one transect of 40 bait stations, while the southern area had three transects with 45 bait stations. Both areas were monitored for 3 nights.

Crab abundance was expressed as the catch per unit of effort (CPUE). CPUE was calculated by the number of crabs captured divided by the number of trapping nights. The number of trapping nights was the number of bait stations multiplied by the number of nights they were monitored. The southern area had 135 trap nights (3 x 45) and the northern area had 120 trap nights.

Figure 1. Location of bait station transect lines.



RESULTS

One crab was captured in the southern area transects. No crabs were captured (or seen) on the northern area. The overall CPUE was 0.004 (1/255 trap nights). The captured crab was a male with a 31mm thoracic length, 62mm thoracic width and weighed 205 grams.

DISCUSSION

The low crab numbers in the sampled areas was surprising. Coconut forest and native forest are generally considered to be excellent habitat for coconut crabs. When compared to surveys of other Marianas Islands that have similar habitats (Guam, Sarigan, Tinian, Aguijuan, and Saipan) (USFWS. 2001, Martin, *et al* 2008, U.S. Navy 2008, Esselstyn, *et al* 2003, Kessler 2006), Pagan would be expected to have more crabs than what was found. Former resident Pete Castro reported shipping 150 crabs per week to Saipan from Pagan in the 1960's and also reported receiving a request for 400 crabs which was presumably sent. The duration of this specific harvesting effort was not documented however it does show that large numbers of coconut crabs were historically harvested on Pagan (Athens 2008). Former Pagan residents who have lived on the island recently reported that while crabs were scarce on most of the island they were still common on the southeast side of the island in the "saddle region" between the two southern peaks. Time constraints did not permit sampling in this area. The same former residents also reported that large coconut crabs use Japanese built, World War II era bunkers as refugia wherever such structures are found. A bunker was pointed out to the author and shredded coconut husks, a sign of crab activity, were observed.

Surveys on the nearby islands of Sarigan (Martin *et al* 2008) and Asuncion (Williams *et al* 2009) both showed demographics skewed to larger/adult crabs. There were few smaller crabs, 35 mm TL, in the samples. This is a sign of low juvenile recruitment or high juvenile mortality. Brown and Fielder (1991) documented low juvenile recruitment on Vanuatu, estimating that substantial recruitment only occurred once every 5 - 10 years. The hypothesized reasons for this were poor beach access and adverse ocean currents negatively affecting the larva's ability to make it back to land. Pigs are also thought to take small crabs that are present in the leaf litter (Kessler *pers. com*., Eldredge 1996) and pigs are very abundant on Pagan. The volcanic eruption in 1981 covered much of the island with ash, most likely killing crabs and degrading crab habitat. A similar volcanic event on Anatahan was documented to have killed all the cabs on that island (Kessler *pers com.*). Entomology surveys (performed at the same time as the crab surveys) documented an infestation of the yellow legged crazy ant (*Anoplolepis gracilipes*) which has been observed to kill crabs on Saipan (*pers. obs*.) and are believed to impact juvenile crabs (Eldredge, 1996.).

Given the aforementioned scenario, it is hypothesized that the low crab numbers on Pagan are due to years of over harvest, which drastically reduced the adult population, and the volcanic eruption which caused both juvenile and adult mortality. After the village on Pagan was evacuated in 1981, crab population recovery may be hindered by: 1) periodic adult harvest by visitation by former inhabitants (or commercial harvest); 2) high juvenile mortality caused by poor larval recruitment from the oceanic stage and 3) predation by pigs (which have increased in

abundance numbers due to the village evacuation) and other predators (ants, feral cats, monitor lizards, dogs). Presently the only areas left with appreciable numbers of crabs are those that are difficult for people to access as evidenced by reports of crabs at elevation on the southeast side of the island.

Because this coconut crabs are important to both culture and ecosystem health in the Marianas, effort is needed to manage this species sustainably on Pagan. Remote sites on Pagan were coconut crabs are still abundant should be documented. Similarly, the causes and level of juvenile crab mortality need to be ascertained to manage the populations properly. People on the inhabited islands in the Marianas (Guam, Saipan, Tinian and Rota) view the collective Northern islands as a pristine paradise that can be harvested at will (*pers. obs*.). Pagan appears to be an example of this thinking.

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